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SCIENCE

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FRIDAY, DECEMBER 9, 1904.

THE RECENT DEVELOPMENT OF BIOLOGY.*

I.

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THE task allotted to me on this occasion is a review of the development of biology during the last century. The limited time at our disposal will necessitate many omissions and will force me to confine myself to the discussion of a few of the departures in biology which have led or promise to lead to fertile discoveries.

The problem of a scientific investigator can always be reduced to two tasks; the first, to determine the independent variables of the phenomena which he has under investigation, and secondly, to find the formula which allows him to calculate the value of the function for every value of the variable. In physics and chemistry the independent variables are in many cases so evident that the investigation may begin directly with the quantitative determination of the relation between the change of the essential variable and the function. In biology, however, the variables, as a rule, can not be recognized so easily and a great part of the mental energy of the investigators must be spent in the search for these variables. To give an example, we know that in many eggs the development only begins after the entrance of a spermatozoon into the egg. The spermatozoon must produce some kind of a change in the egg, which is responsible for the development. But we do not know which variable in the egg is changed by the spermatozoon, whether the latter pro-

* Address delivered at the Congress of Arts and Science in St. Louis.